Mark R. Petersen

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RESEARCH INTERESTS

Investigations of geophysical and astrophysical flows using reduced equations and numerical models; quasi-geostrophic turbulence; planetary formation in protoplanetary disks; dynamics of mixing and entrainment in ocean overflows; LANS-alpha turbulence model; numerical methods for climate models; education in science and engineering

EDUCATION

Ph.D., Applied Mathematics, 2004, GPA:3.97
University of Colorado at Boulder
Dissertation Topic: Study of Geophysical and Astrophysical Turbulence using Reduced Equations
Advisors: Keith Julien (Applied Math), Jeffrey B. Weiss (PAOS), Glen R. Stewart (LASP)

M.S., Atmospheric and Oceanic Science, 2002, GPA:3.97
University of Colorado at Boulder

M.S., Mathematics and Statistics, 2000, GPA:3.94
University of Nebraska-Lincoln

B.S., Environmental Engineering, 1995, GPA:3.84
University of Nebraska-Lincoln

PROFESSIONAL EXPERIENCE

Postdoctroal Research Associate,   **2005 - present**
Los Alamos National Laboratory,
Center for Nonlinear Studies, Theoretical Div., Computer and Computational Science Div.
- Creating LANS-alpha version of the POP ocean model.
- Investigating dynamics of mixing and entrainment in ocean overflows through comparison of direct numerical simulations with laboratory experiments. The ultimate goal is to improve the subgrid-scale representation of mixing and entrainment in ocean models.
- Member of NCAR's Ocean Working Group for the Community Climate System Model

Graduate student researcher and instructor   **2000 - 2004**
University of Colorado-Boulder, Department of Applied Mathematics
- Created 3D pseudo-spectral numerical model of slanted quasi-geostrophic regime to investigate vortex merger and alignment, energy cascade, and vortex formation.
- Investigation of baroclinic instabilities, Rossby waves, and vortices that affect planetary formation in protoplanetary disks. Created 2D pseudo-spectral numerical model on an annulus.
- Instructor, Differential Equations and Linear Algebra.
- Advisor and tutor to undergraduate research groups in computational fluid dynamics and atmospheric data analysis.
- Grader and substitute lecturer for graduate fluid dynamics, graduate atmospheric dynamics.

Mentor and consultant for undergraduate scientist program   **2002 - 2004**
National Center for Atmospheric Research
- Programming tutor and consultant in Matlab and Fortran for NCAR's Significant Opportunities in Atmospheric Research and Science (SOARS) program. (25 participants)
- Mentor in NCAR's Climate Change Research Section, with Warren Washington
    2002: 3D visualization of climate model output
    2003: Wavelet correlations of NCEP reanalysis and climate model output.
- Research in Bachelors and PhD degrees conferred to underrepresented minorities and women in science and engineering.

Reviewer and proofreader of atmospheric science texts   2003 - 2004
- Proofread problems and solutions manual for James R. Holton, *An Introduction to Dynamic Meteorology, 4th ed*, all chapters.
- Reviewed and proofread *A Climate Modelling Primer, 3rd ed* by K. McGuffie and A. Henderson-Sellers, two chapters.

Graduate student researcher and instructor   1998 - 2000
University of Nebraska-Lincoln, Department of Mathematics
- Created a numerical model of flow though a reactive porous media.
- Instructor for intermediate algebra, college algebra, mathematics for elementary school teachers, and calculus recitations.

Project Engineer, Air Pollution Control Systems   1996 - 1998
U.S. Filter/RJ Environmental, San Diego, CA
- Responsible for Emergency Chlorine Scrubber product line, including design, fabrication details, and installation.
- Trained five new engineers.
- Designed packed-tower and activated carbon odor control systems.

HONORS AND AWARDS
- NSF VIGRE Graduate Student Fellowship, Spring 2002 to Fall 2004
- NASA Summer School for High Performance Computational Earth and Space Sciences
  Goddard, Maryland, July 7 to 25, 2003
- Helmholtz Institute for Supercomputational Physics
  Scientific Supercomputing in Climate Research
  Potsdam, Germany, August 26 to September 20, 2002
- CU Engineering Excellence Fund co-author, resulted in the successful acquisition of a $20,000 grant to renovate the Applied Mathematics Department's computer facility.

PUBLICATIONS

Petersen, M.R., K. Julien, and G.R. Stewart: 2005, Baroclinic vorticity production in protoplanetary disks, *in preparation*.

Petersen, M.R., K. Julien, and J.B. Weiss: 2005, Vortex cores, circulation cells, and filaments in quasi-geostrophic turbulence, *submitted to Physics of Fluids*.

Petersen, M.R., B. Kraus, and T. Windham: 2005, Striving towards equity; Underrepresented minorities and mathematics, *SIAM News,* March (Part I), April (Part II).

Petersen, M.R.: 2004, Musical analysis and synthesis using Matlab. *College Mathematics Journal,* **35**, 5, p.396-401

Windham, T., B. Kraus, and M.R. Petersen: 2004, Striving Towards Equity; Underrepresented Minorities and Women in Natural Sciences and Engineering. *NSF Alliances for Graduate Education and the Professoriate (AGEP), January 2004 meeting.*

J.D. Logan, M.R. Petersen, and T.S. Shores: 2002, Numerical study of reaction-mineralogy-porosity changes in porous media, *Applied Mathematics and Computation*, **127**, 149-164.

Rinkol, M., M.R. Petersen, D.D. Schulte, S.B. Verma and D.P. Billesbach: 2000, A review of the Gaussian plume model in the context of the agricultural industry. Paper MC 00-118. *Mid-Central Meeting of the ASAE*, April 28-29. 19 p.

Honold, C.U., A. Gronauer, H. Stanzel, M.R. Petersen: 1995, Computergestützte Flüssigmistaus-bringsysteme - Ergebnisse aus Prüfstandsversuchen zur Längs- und Querverteilgenauigkeit. (Computer based slurry distribution system: Performance of a test rig for longitudinal and latitudinal accuracy) *Landtechnik (Agricultural Engineering)* **50** (5), 276-283.

Schulte, D.D., R.E. Eigenberg and M.R. Petersen: 1994, Evaluation of waste management decision making tools, *Great Plains Agricultural Council Publication*, **151**, 154-160.

COMPUTER SKILLS
- Languages: Extensive experience in Fortran 77, Fortran 90, Open MP, MPI, and Matlab.
- Algorithms: Pseudospectral methods, fast Fourier transforms, Runge-Kutta methods.